

**FINAL JEE(Advanced) EXAMINATION - 2019****(Held On Monday 27<sup>th</sup> MAY, 2019)****PAPER-2****TEST PAPER WITH ANSWER & SOLUTION****PART-2 : CHEMISTRY****SECTION-1 : (Maximum Marks: 32)**

- This section contains **EIGHT (08)** questions.
- Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s)
- Answer to each question will be evaluated according to the following marking scheme:

*Full Marks* : +4 If only (all) the correct option(s) is (are) chosen.

*Partial Marks* : +3 If all the four options are correct but **ONLY** three options are chosen.

*Partial Marks* : +2 If three or more options are correct but **ONLY** two options are chosen and both of which are correct.

*Partial Marks* : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

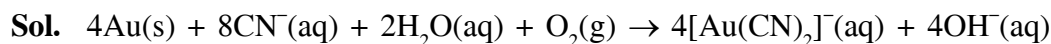
*Zero Marks* : 0 If none of the options is chosen (i.e. the question is unanswered).

*Negative Marks* : -1 In all other cases.

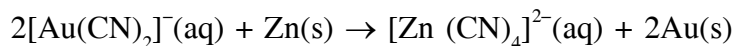
- For example, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to correct answers, then  
 choosing **ONLY** (A), (B) and (D) will get +4 marks;  
 choosing **ONLY** (A) and (B) will get +2 marks;  
 choosing **ONLY** (A) and (D) will get +2 marks;  
 choosing **ONLY** (B) and (D) will get +2 marks;  
 choosing **ONLY** (A) will get +1 marks;  
 choosing **ONLY** (B) will get +1 marks;  
 choosing **ONLY** (D) will get +1 marks;  
 choosing no option (i.e. the question is unanswered) will get 0 marks, and  
 choosing any other combination of options will get -1 mark.

- The cyanide process of gold extraction involves leaching out gold from its ore with  $\text{CN}^-$  in the presence of **Q** in water to form **R**. Subsequently, **R** is treated with **T** to obtain Au and **Z**. Choose the correct option(s).
  - T** is Zn
  - R** is  $[\text{Au}(\text{CN})_4]^-$
  - Z** is  $[\text{Zn}(\text{CN})_4]^{2-}$
  - Q** is  $\text{O}_2$

**Ans. (1,3,4)**



(Q)

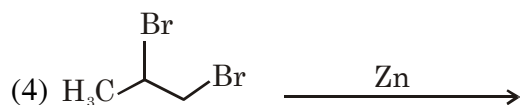
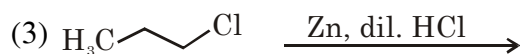
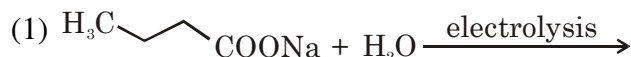


(R)

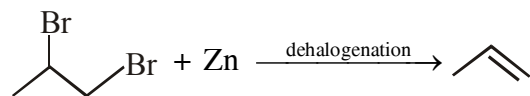
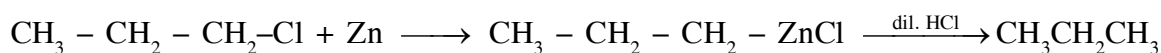
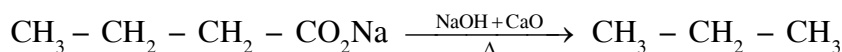
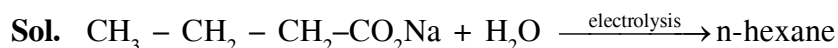
(T)

(Z)

2. Which of the following reactions produce(s) propane as a major product?



**Ans. (2,3)**



3. The ground state energy of hydrogen atom is  $-13.6 \text{ eV}$ . Consider an electronic state  $\Psi$  of  $\text{He}^+$  whose energy, azimuthal quantum number and magnetic quantum number are  $-3.4 \text{ eV}$ , 2 and 0 respectively. Which of the following statement(s) is(are) true for the state  $\Psi$ ?

(1) It has 2 angular nodes

(2) It has 3 radial nodes

(3) It is a 4d state

(4) The nuclear charge experienced by the electron in this state is less than  $2e$ , where  $e$  is the magnitude of the electronic charge.

**Ans. (1,3)**

**Sol.** #  $-3.4 = \frac{-13.6 \times 4}{n^2}$

$n = 4$

#  $\ell = 2$

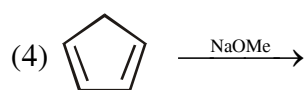
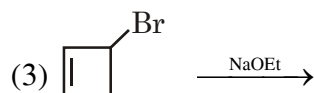
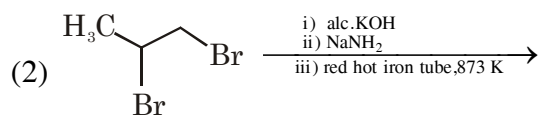
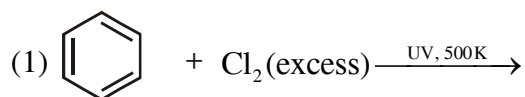
#  $m = 0$

Angular nodes =  $\ell = 2$

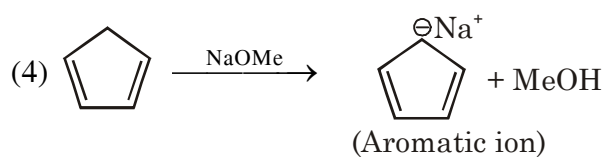
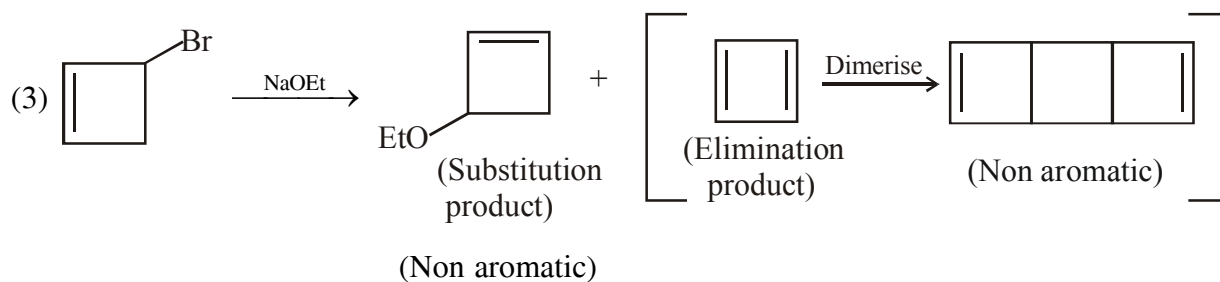
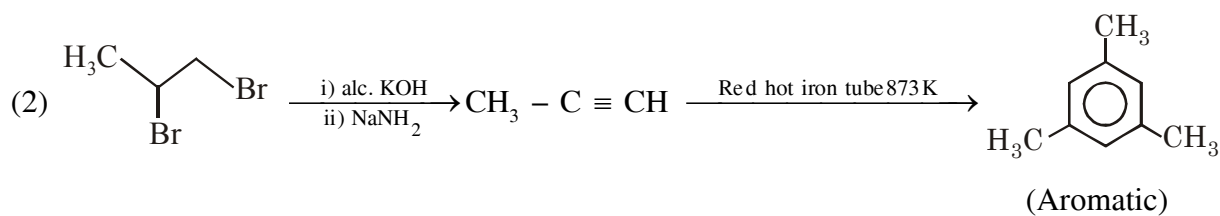
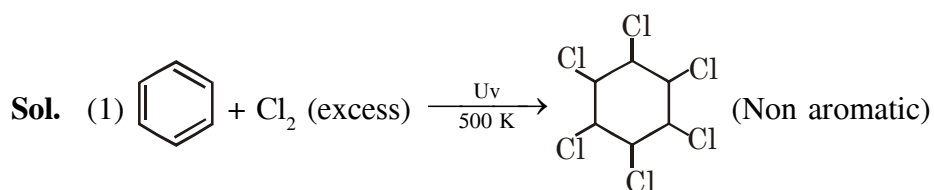
Radial nodes =  $(n - \ell - 1) = 1$

$n \ell = 4d$  state

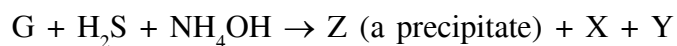
4. Choose the correct option(s) that give(s) an aromatic compound as the major product.



Ans. (2,4)



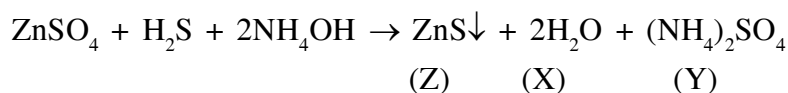
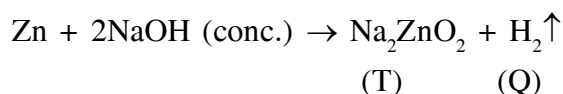
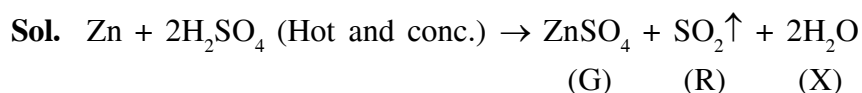
**5.** Consider the following reactions (unbalanced)



Choose the correct option(s).

- (1) The oxidation state of Zn in T is +1
- (2) Bond order of Q is 1 in its ground state
- (3) Z is dirty white in colour
- (4) R is a V-shaped molecule

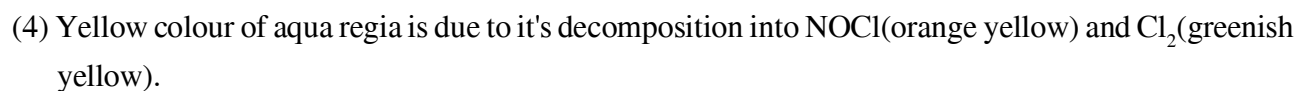
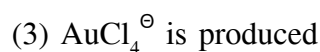
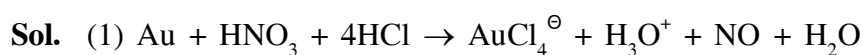
**Ans. (2,3,4)**



6. With reference to *aqua regia*, choose the correct option(s).

- (1) Reaction of gold with *aqua regia* produces  $\text{NO}_2$  in the absence of air
- (2) *Aqua regia* is prepared by mixing conc.  $\text{HCl}$  and conc.  $\text{HNO}_3$  in 3 : 1 (v/v) ratio
- (3) Reaction of gold with *aqua regia* produces an anion having Au in +3 oxidation state
- (4) The yellow colour of *aqua regia* is due to the presence of  $\text{NOCl}$  and  $\text{Cl}_2$

**Ans. (2,3,4)**



7. Choose the correct option(s) from the following

- (1) Natural rubber is polyisoprene containing *trans* alkene units
- (2) Nylon-6 has amide linkages
- (3) Cellulose has only  $\alpha$ -D-glucose units that are joined by glycosidic linkages
- (4) Teflon prepared by heating tetrafluoroethene in presence of a persulphate catalyst at high pressure

**Ans. (2,4)**

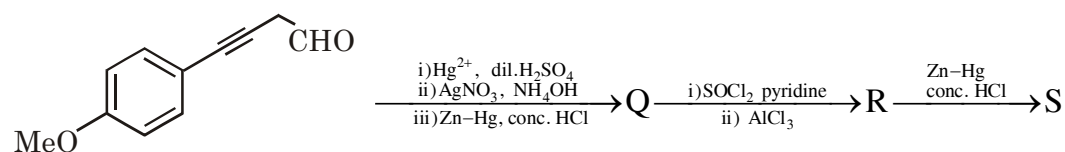
**Sol.** 1. Natural rubber is polyisoprene containing *cis* alkene units

2. Nylon-6 has amide linkage  $\text{---HN---(CH}_2\text{)}_5\text{---C(=O)---}$

3. Cellulose has only  $\beta$ -D glucose units.

4.  $\text{F}_2\text{C}=\text{CF}_2 \xrightarrow{\text{Per sulphate}} \text{---CF}_2\text{---CF}_2\text{---}_n$

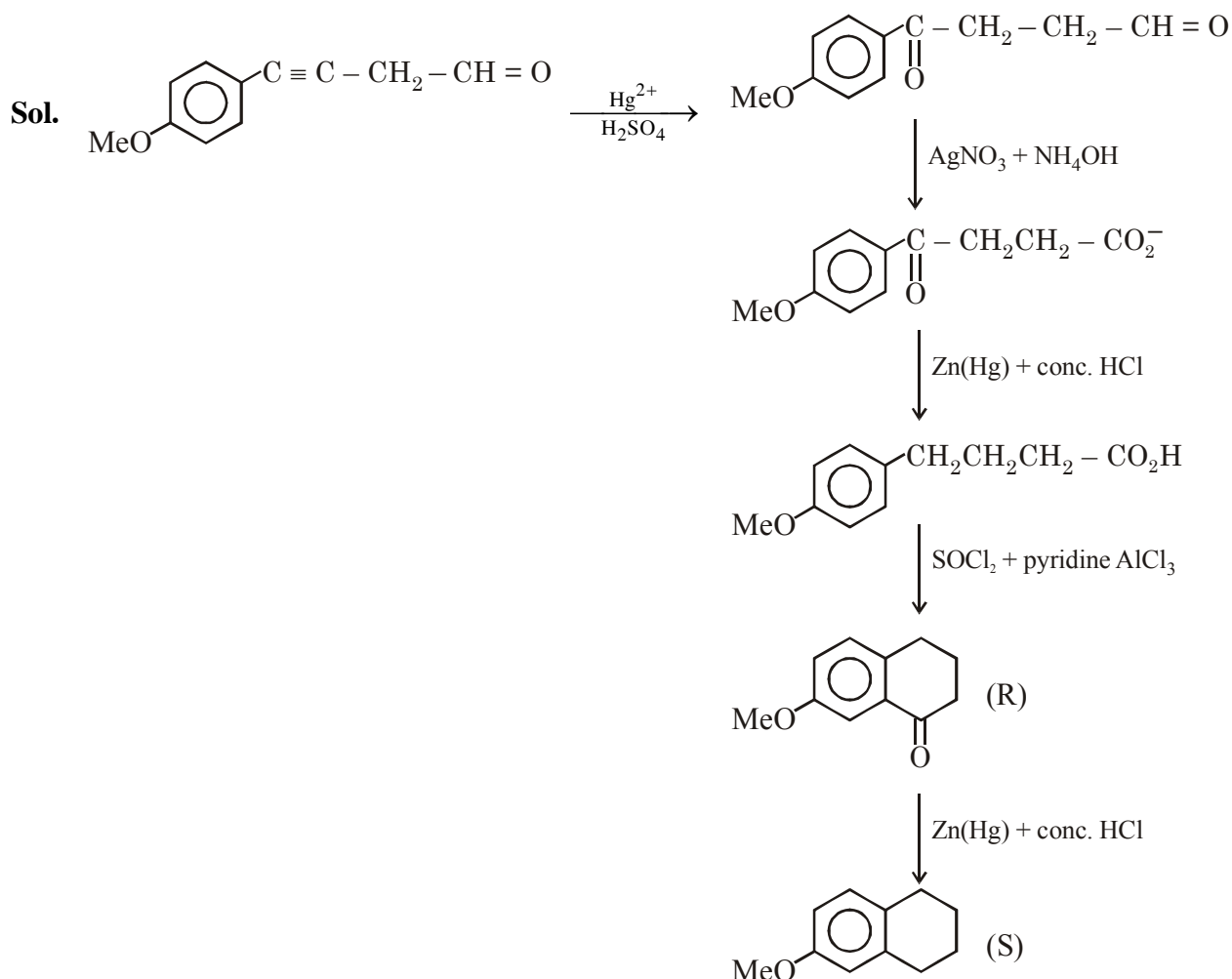
8. Choose the correct option(s) for the following reaction sequence



Consider Q, R and S as major products

- (1) **Q**      **S**
- (2) **Q**      **R**
- (3) **R**      **S**
- (4) **R**      **S**

Ans. (2,4)

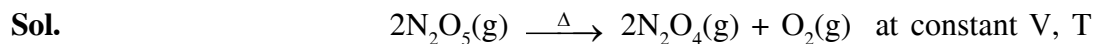


## SECTION-2 : (Maximum Marks: 18)

- This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value of the answer using the mouse and the on-screen virtual numeric keypad in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **Two** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:  
*Full Marks* : +3 If ONLY the correct numerical value is entered.  
*Zero Marks* : 0 In all other cases.

- The decomposition reaction  $2\text{N}_2\text{O}_5(\text{g}) \xrightarrow{\Delta} 2\text{N}_2\text{O}_4(\text{g}) + \text{O}_2(\text{g})$  is started in a closed cylinder under isothermal isochoric condition at an initial pressure of 1 atm. After  $Y \times 10^3$  s, the pressure inside the cylinder is found to be 1.45 atm. If the rate constant of the reaction is  $5 \times 10^{-4} \text{ s}^{-1}$ , assuming ideal gas behavior, the value of Y is \_\_\_\_

Ans. (2.30)



$$t = 0 \quad 1$$

$$t = y \times 10^3 \text{ sec} \quad (1 - 2P) \quad 2P \quad P$$

$$P_T = (1 + P) = 1.45$$

$$P = 0.45 \text{ atm}$$

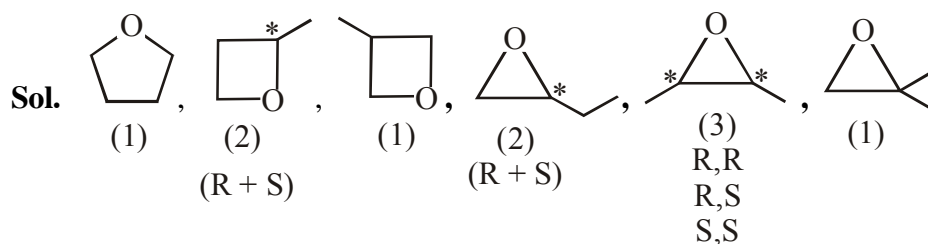
$$(2K)t = 2.303 \log \left( \frac{1}{1-2P} \right)$$

$$(2 \times 5 \times 10^{-4}) \times y \times 10^3 = 2.303 \log \frac{1}{0.1}$$

$$y = 2.303 = 2.30$$

2. Total number of isomers, considering both structural and stereoisomers, of cyclic ethers with the molecular formula  $\text{C}_4\text{H}_8\text{O}$  is \_\_\_\_

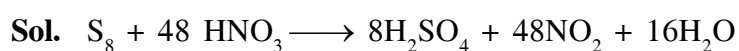
**Ans. (10.00)**



3. The amount of water produced (in g) in the oxidation of 1 mole of rhombic sulphur by conc. $\text{HNO}_3$  to a compound with the highest oxidation state of sulphur is \_\_\_\_

(Given data : Molar mass of water =  $18 \text{ g mol}^{-1}$ )

**Ans. (288.00)**

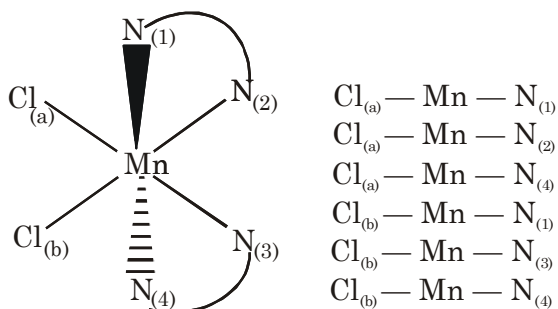


1 mole of rhombic sulphur produce 16 mole of  $\text{H}_2\text{O}$  i.e. 288 gm of  $\text{H}_2\text{O}$

4. Total number of *cis* N—Mn—Cl bond angles (that is, Mn—N and Mn—Cl bonds in *cis* positions) present in a molecule of *cis*-[Mn(en)<sub>2</sub>Cl<sub>2</sub>] complex is \_\_\_\_ (*en* = NH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub>)

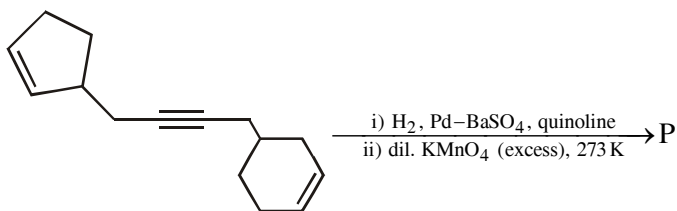
Ans. (6.00)

Sol. *cis*[M(en)<sub>2</sub>Cl<sub>2</sub>]

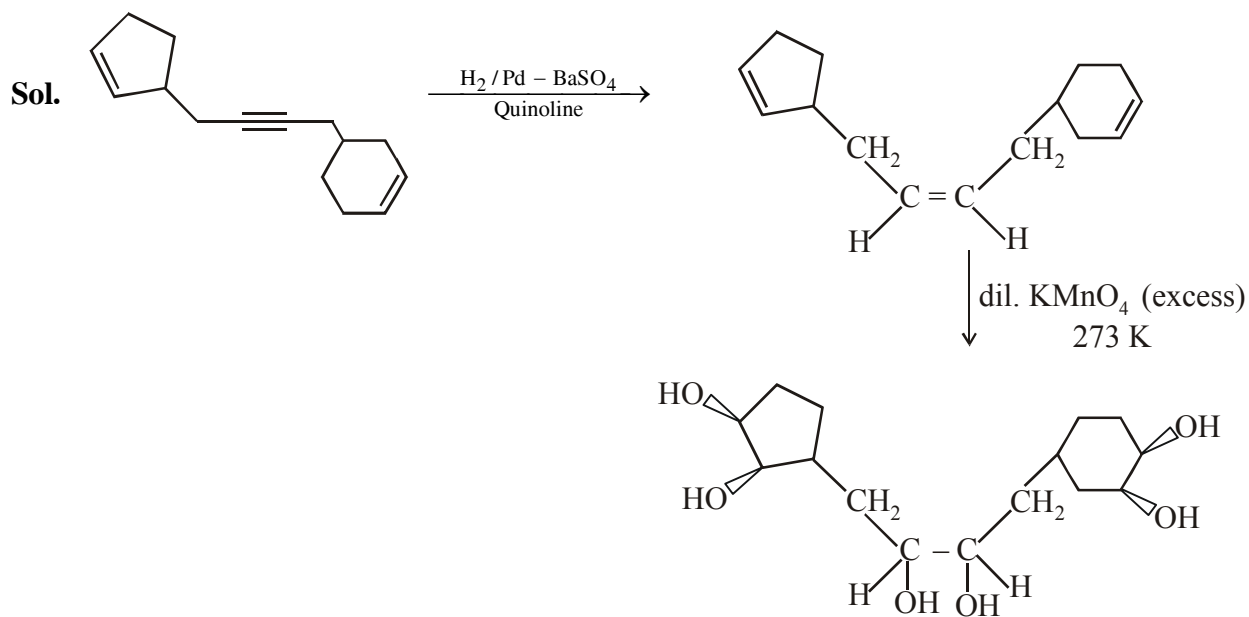


Number of *cis* (Cl—Mn—N) = 6

5. Total number of hydroxyl groups present in a molecule of the major product P is \_\_\_\_



Ans. (6.00)



total 6 —OH group present in a molecule of the major product.



6. The mole fraction of urea in an aqueous urea solution containing 900 g of water is 0.05. If the density of the solution is  $1.2 \text{ g cm}^{-3}$ , the molarity of urea solution is \_\_\_\_

(Given data : Molar masses of urea and water are  $60 \text{ g mol}^{-1}$  and  $18 \text{ g mol}^{-1}$ , respectively)

**Ans. (2.98 or 2.99)**

**Sol.**  $X_{\text{urea}} = 0.05 = \frac{n}{n+50}$   
 $19n = 50$   
 $n = 2.6315$

$$V_{\text{sol}} = \frac{(2.6315 \times 60 + 900)}{1.2} = 881.5789 \text{ ml}$$

$$\text{Molarity} = \frac{2.6315 \times 1000}{881.5789} = 2.9849$$

$$\text{Molarity} = 2.98\text{M}$$

### SECTION-3 : (Maximum Marks : 12)

- This section contains **TWO (02)** List-Match sets.
- Each List-Match set has **Two (02)** Multiple Choice Questions.
- Each List-Match set has two lists : **List-I** and **List-II**
- **List-I** has **Four** entries (I), (II), (III) and (IV) and **List-II** has **Six** entries (P), (Q), (R), (S), (T) and (U)
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme :

*Full Marks* : +3 If **ONLY** the option corresponding to the correct combination is chosen.

*Zero Marks* : 0 If none of the options is chosen (i.e., the question is unanswered);

*Negative Marks* : -1 In all other cases

1. Answer the following by appropriately matching the lists based on the information given in the paragraph

Consider the Bohr's model of a one-electron atom where the electron moves around the nucleus. In the following List-I contains some quantities for the  $n^{\text{th}}$  orbit of the atom and List-II contains options showing how they depend on  $n$ .

List-I	List-II
(I) Radius of the $n^{\text{th}}$ orbit	(P) $\propto n^{-2}$
(II) Angular momentum of the electron in the $n^{\text{th}}$ orbit	(Q) $\propto n^{-1}$
(III) Kinetic energy of the electron in the $n^{\text{th}}$ orbit	(R) $\propto n^0$
(IV) Potential energy of the electron in the $n^{\text{th}}$ orbit	(S) $\propto n^1$
	(T) $\propto n^2$
	(U) $\propto n^{1/2}$

Which of the following options has the correct combination considering List-I and List-II?

- (1) (II), (R)                      (2) (I), (P)                      (3) (I), (T)                      (4) (II), (Q)

**Ans. (3)**

$$\text{Sol. } r = 0.529 \times \frac{n^2}{Z} \quad \Rightarrow \quad r \propto n^2 \quad \Rightarrow \text{(I) (T)}$$

$$mvr = \frac{nh}{2\pi} \quad \Rightarrow \quad (mvr) \propto n \quad \Rightarrow \text{(II) (S)}$$

$$KE = +13.6 \times \frac{Z^2}{n^2} \quad \Rightarrow \quad KE \propto n^{-2} \quad \Rightarrow \text{(III) (P)}$$

$$PE = -2 \times 13.6 \times \frac{Z^2}{n^2} \Rightarrow PE \propto n^{-2} \quad \Rightarrow \text{(IV) (P)}$$

**2. Answer the following by appropriately matching the lists based on the information given in the paragraph**

Consider the Bohr's model of a one-electron atom where the electron moves around the nucleus. In the following List-I contains some quantities for the  $n^{\text{th}}$  orbit of the atom and List-II contains options showing how they depend on  $n$ .

**List-I**

- (I) Radius of the  $n^{\text{th}}$  orbit
- (II) Angular momentum of the electron in the  $n^{\text{th}}$  orbit
- (III) Kinetic energy of the electron in the  $n^{\text{th}}$  orbit
- (IV) Potential energy of the electron in the  $n^{\text{th}}$  orbit

**List-II**

- (P)  $\propto n^{-2}$
- (Q)  $\propto n^{-1}$
- (R)  $\propto n^0$
- (S)  $\propto n^1$
- (T)  $\propto n^2$
- (U)  $\propto n^{1/2}$

Which of the following options has the correct combination considering List-I and List-II?

- (1) (III), (S)                      (2) (IV), (Q)                      (3) (IV), (U)                      (4) (III), (P)

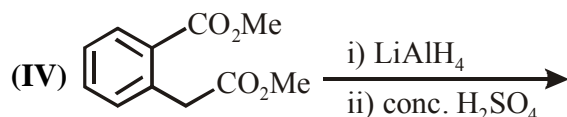
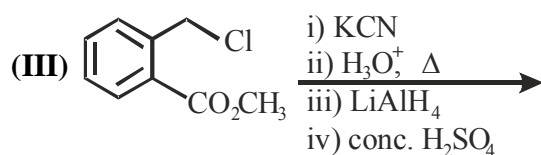
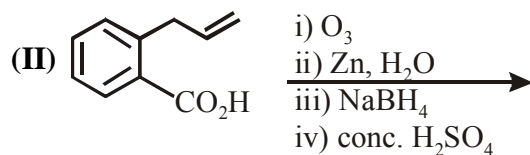
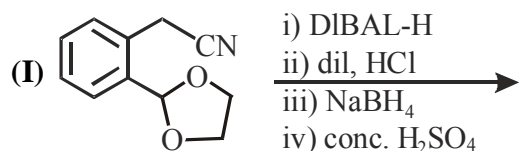
**Ans. (4)**

**Sol.** Same as 1 (Section-3)

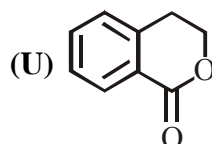
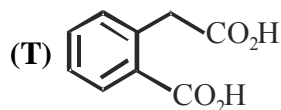
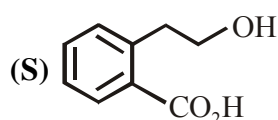
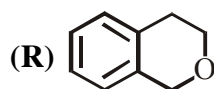
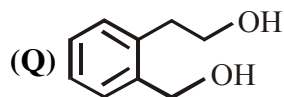
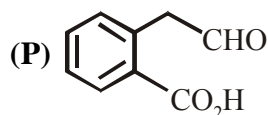
3. Answer the following by appropriately matching the lists based on the information given in the paragraph

List-I includes starting materials and reagents of selected chemical reactions. List-II gives structures of compounds that may be formed as intermediate products and/or final products from the reactions of List-I

**List-I**



**List-II**



Which of the following options has correct combination considering List-I and List-II?

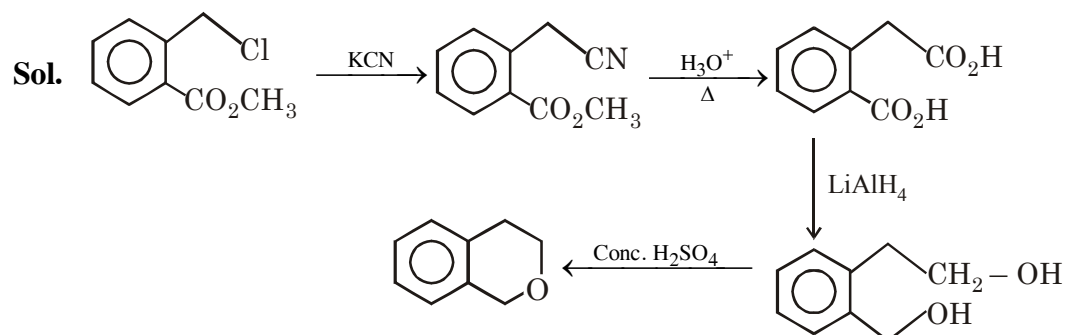
(1) (III), (S), (R)

(2) (IV), (Q), (R)

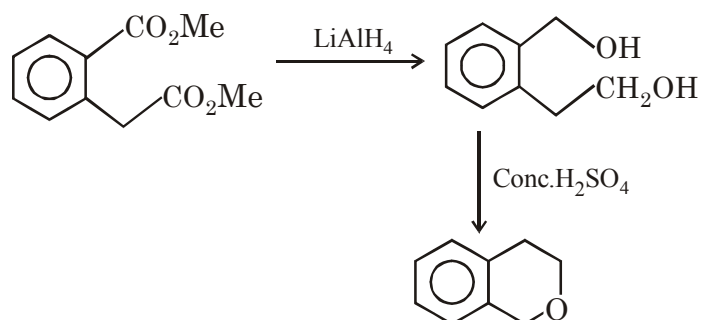
(3) (III), (T), (U)

(4) (IV), (Q), (U)

**Ans. (2)**



**III, T, Q, R**

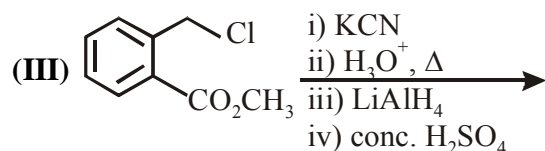
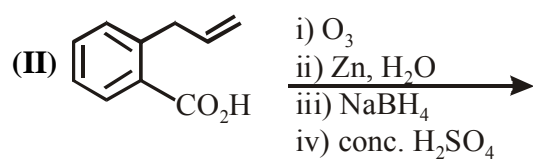
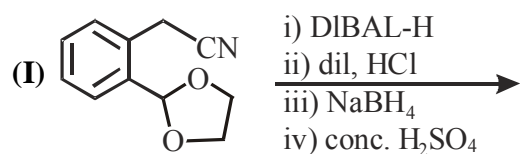


**IV, Q, R**

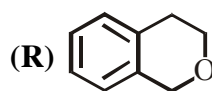
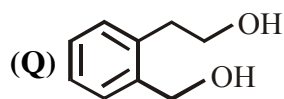
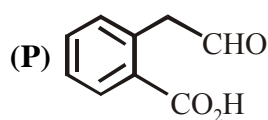
4. Answer the following by appropriately matching the lists based on the information given in the paragraph

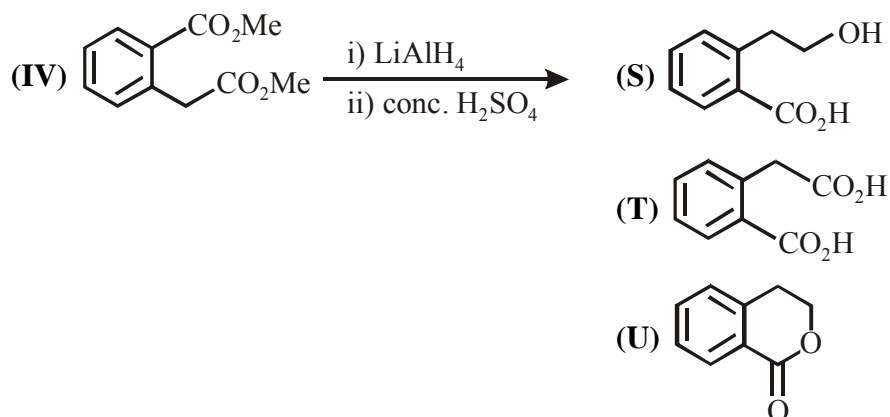
List-I includes starting materials and reagents of selected chemical reactions. List-II gives structures of compounds that may be formed as intermediate products and/or final products from the reactions of List-I

**List-I**



**List-II**





Which of the following options has correct combination considering List-I and List-II?

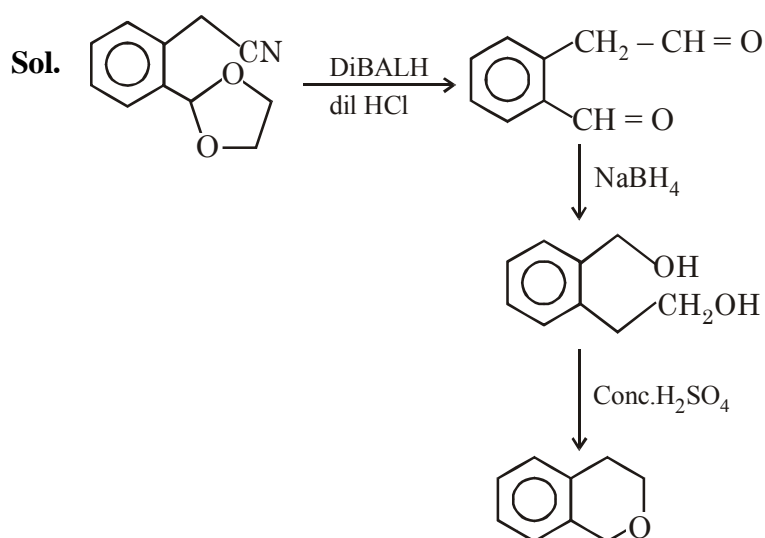
(1) (I), (Q), (T), (U)

(2) (II), (P), (S), (U)

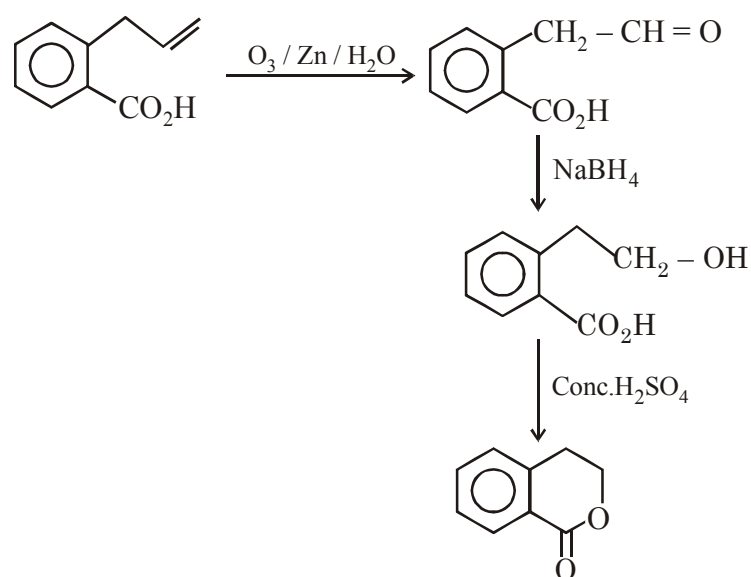
(3) (II), (P), (S), (T)

(4) (I), (S), (Q), (R)

Ans. (2)



I, Q, R



II, P, S, U